gards alternating currents, it seems to us highly probable that after some years the wires will show unexpected changes in brittleness and tensile strength. We know scarcely anything yet about heavy alternating currents.

Certain facts, however, in regard to the electrical qualities of an insulating sheath may be determined by tests. With this object in view, experiments were made in the spring of this year, in the physical laboratory of the State University, upon six of the principal arc-light wires in the market. All of them had been in outside use by the Lawrence Electric Light Company. These tests were made to determine the insulating power of the wires against leakage when exposed to moisture. The wires were No. 6, American wire gauge, guaranteed by the makers to be water-proof. Lengths of about 25 feet were taken, wound into coils, and immersed in large tubs filled with hydrant-water. The two ends of each coil projected about two feet out of the water. The coils were left in the water for nearly three months, measurements at first being made every day so long as considered necessary. The mode of testing was that known as the substitution method. One of the projecting ends of a coil of wire was connected to a delicate Wiedemann adjustable-coil dead-beat mirror galvanometer and to the positive pole of a single gravity cell. The negative pole was connected by a wire to a copper plate 20 inches square, which was placed in each tub of water, in the center of the coil. The other projecting end of each coil was left insulated in the air. Resistance boxes reading to 100,000 and 33,000 ohms, respectively, were so connected that they could be substituted in the circuit of the galvanometer and battery in place of any particular coil. For convenience, a special mercury switch was so constructed that the observer could throw in succession the different coils or the resistance boxes into the galvanometer circuit, and by equal deflections the resistances of the insulation sheaths could be determined. It is evident by the arrangements of the experiment, that only through the insulating layer of the wire could the current escape to complete the galvanometer circuit; and from the reputation of the wires, only a small leakage was to be expected. The insulation resistance should be several million ohms per mile. We have embodied our results in the form of curves indicated in the following diagram. (Explain curves.) After three months' immersion final tests were made, which gave the following results:

| | |
|---|---|
| No. 1 | 7,200 ohms per yard. |
| No. 2 | 8,067 ohms per yard. |
| No. 3 | 816,000 ohms per yard. |
| No. 4 | 7,333 ohms per yard. |
| No. 5 | 3,702 ohms per yard. |
| No. 6 | 3,300 ohms per yard. |

As the result of these tests, No. 3 is now used almost exclusively on the Lawrence electric light circuits; and at this writing, after nearly a year of out-door exposure, the insulation seems as perfect as at first.

## ON BARITE AND ASSOCIATED MINERALS IN THE CONCRETIONARY ROCKS OF EASTERN KANSAS.

BY PROF. E. H. S. BAILEY, AND E. E. SLOSSON, LAWRENCE.

[*Abstract.*]

These rocks are found as boulders upon the hills in the vicinity of Lawrence, especially upon Mount Oread. It seems probable that there is a layer of these rocks below the surface. Similar boulders are found in Jefferson county along the line of the narrow-gauge road, in some places beneath layers of clay and above the lime-

stone strata. The rocks on being broken open are found to contain crystals of a white and a pinkish mineral, and numerous patches of sphalerite with small particles of pyrite. The associated rock is a gray, siliceous limestone, readily attacked by dilute acids. The minerals occur in radiated masses of thin bladed crystals and in veins of a centimeter or less in thickness, which divide the rock into irregular polyhedrons. The sphalerite is dark brown with yellow streaks, and has the ordinary resinous luster.

There seem to be two distinct minerals in the veins. One of them occurs in opaque pink crystals, and often in masses of irregular shape. These crystals decrepitate readily, and give both the barium and strontium flames. The streak is white, and there is slight effervescence with acid. An approximate analysis gives barium sulphate, 80 per cent.; strontium sulphate, 14 per cent.; with small quantities of silica and iron and calcium carbonate. This corresponds quite closely in composition to the so-called celesto-barite of von Waltershausen.

The second mineral when carefully picked appeared quite different. It occurs in transparent colorless crystals, varying in shape from flat rhombic to needle-shaped prismatic. In some places they are colored by red oxide of iron, which was removed as completely as possible. It decrepitates and gives a distinct strontium and a faint barium flame. Approximate analysis gives strontium sulphate, 96 per cent.; barium sulphate, 1 per cent.; with small quantities of silica and calcium carbonate, and shows it to be celestite.

## SOME NOTES ON THE MALLOPHAGA.

BY VERNON L. KELLOGG, LAWRENCE, KANSAS.

The Mallophaga (bird-lice) have been little studied. Nitzsch, and more recently Grosse, both of Germany, have devoted attention to the classification and to the anatomy of these insects. In the United States practically no work has been done in reference to them. As to anatomy, Grosse's "*Beitrage zur Kenntniss der Mallophagen*" may be considered the best authority, and as to classification, the scheme of Nitzsch is accepted. The Mallophaga have no well-defined position in the insect world. Packard in his latest publications arranges them with the white ants and stone-flies, making the order Platyptera.

The writer has noted and described, with full microscopic measurements, twenty-four species representing ten genera taken from Kansas birds. As no list of American species has been made, the specimens are arranged by genera and given species numbers. The writer discovers among these specimens types of two new genera which he introduces into Nitzsch's classification, and has fully described. Also are noted certain points which are essential to the classification of the Mallophaga and which are, with some hesitation, introduced into Nitzsch's scheme. Well-defined relations between certain families and genera of Mallophaga and certain orders and families of Aves are apparent, the distribution of the insects being evidently affected by the characteristic habits of the hosts. A series of forty specimens of Mallophaga, mounted on glass slides serves to exhibit external differences among the species so far observed. Observations on the anatomy, gross and minute, have been made to a limited extent, Dr. Grosse's monograph being very complete. Notes on the respiratory system of Tetropthalmus, as shown by accompanying cut of a clarified specimen have been made. Notes on alimentary canal content, upholding the declarations of Grosse that the Mallophaga eat feathers alone, and blood only indirectly, *i. e.*, when on the feathers by reason of a wound or mange, have been made. In observation of the digestive system in Docophorus, it is noted that the anus is a long